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## CLEANING ARTICLE AND ITS MANUFACTURING METHOD

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### Abstract

#### Purpose

To provide a cleaning article, with excellent ability to trap large soil [particles] such as basis weight utilizing projections and depressions of a nonwoven fabric and the ability to trap of cotton lint, yarn flocks, hairs, etc., caused by an entangling effect of unwoven fabric fibers with a high degree of freedom, not to mention excellent adsorption and retention of soil [particles] such as fine dust from which it is difficult to discharge the fiber flocks during cleaning or is difficult to tear [the fabric] and causes little stickiness of hands, and its manufacturing method.

## Constitution

The cleaning article of the present invention is characterized by the fact that on a cleaning sheet, in which a fiber assembly, in the shape of a nonwoven fabric formed on one surface or both surfaces of a netted sheet by entangling fibers of a fiber web, is also integrated in an entangled state with said netted sheet along with entangling between its constituting fibers and in which many projections and depressions are formed on the surface of the above-mentioned fiber assembly, and [in which] 0.1-500% of the chemical relative to the weight weight of the above-mentioned fiber assembly is carried.

## Claims

1. A cleaning article characterized by the fact that on a cleaning sheet in which a fiber assembly, in the shape of a nonwoven fabric formed on one surface or both surfaces of a netted sheet by entangling fibers of a fiber web is also integrated in an entangled state with said netted sheet along with entangling between its constituting fibers, and in which many projections and depressions are formed on the surface of the above-mentioned fiber assembly, and 0.1-500% chemical relative to the weight of the above-mentioned fiber assembly is carried.

2. The cleaning article of Claim 1, characterized by the fact that the above-mentioned netted sheet is a heat-shrinkable net made of a thermoplastic resin obtained by stretching or a heat-shrinkable net woven or knitted by a stretchable thermoplastic resin filament.

3. The cleaning article of Claim 1 or 2, characterized by the fact that the above-mentioned chemical includes at least one or more selected from mineral oil, synthetic oil, silicone oil, and surfactant.

4. The cleaning article of Claim 3, characterized by the fact that the viscosity of the above-mentioned mineral oil, synthetic oil, and silicone oil is 5-1000 cPs per year at 25°C.

5. The cleaning article of Claims 1-4 characterized by the fact that the above-mentioned cleaning article is mounted on a tool with a handle.

6. A method for manufacturing the cleaning article, characterized by the fact that in a method for manufacturing the cleaning article of Claim 1, a fiber web is laminated on the one surface or both surfaces of a heat-shrinkable netted sheet, a fiber assembly is formed in the shape of a nonwoven fabric by entangling the constituting fibers of the above-mentioned fiber web and the netted sheet or the constituting fibers of the above-mentioned fiber web, it is integrated with the netted sheet, the above-mentioned netted sheet is thermally shrunk by heating, a cleaning sheet is prepared by providing projections and depressions over the entire fiber assembly part with a nonwoven fabric shape, and said cleaning sheet is impregnated with a chemical before or after heating said cleaning sheet.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention pertains to a cleaning article for business and home, utilizing a nonwoven fabric, and its manufacturing method.

[0002]

Prior art

As a conventional cleaning article, many materials based on a nonwoven fabric have been proposed, however, a chemically [treated] floor cloth, which is a conventional cleaning article, is generally formed by impregnating a planar woven fabric or unwoven fabric with an oily substance. However, for high performances such as dust absorption for removing soil on the surface being cleaned by adsorption, soil retention for retaining the soil picked up, and prevention of damage to the cleaning surface being cleaned, it is suggested to use a softer bulky unwoven fabric as the material for a cleaning article.

[0003]

As a method for manufacturing a bulky unwoven fabric as a cleaning article, a method in which a general unwoven fabric is formed postprocessed by stitching, etc., as described in Japanese

Kokai Patent Application No. Sho 64[1989]-61546, a method for making hairs stand as described in Japanese Kokai Patent Application No. Hei 2[1990]-124122, a method using elastic or crimped fibers in all or part of the fibers which constitute a nonwoven fabric as described in Japanese Kokai Patent Application Nos. Hei 2[1990]-160962 and Hei 2[1990]-191422, etc., are mentioned.

[0004]

Also, the development of a bulky unwoven fabric, as shown in Japanese Kokai Patent Application No. Hei 1[1989]-164312, etc., is not limited to cleaning articles but is also applied to cushion materials, packaging materials, or surface materials for hygienic products.

[0005]

Problems to be solved by the invention

However, the above-mentioned bulky unwoven fabric has the following problems. In the bulking by the postprocessing of a general unwoven fabric and the bulking standing of hairs, a larger amount of unwoven fabric and raw fiber material must be used to allow the bulking, and once cleaning is carried out by applying pressure, the surface in contact with the surface being cleaned is fixed, so that the unwoven fabric and fibers of the inner layer which constitutes the thickness of the unwoven fabric cannot make contact with the surface being cleaned. Thus, the

degree of utilization of the unwoven fabric, which is a base material, is inefficient.

[0006]

Also, in the method for generating bulky projections and depressions utilizing the elasticity and the crimping characteristic of the fibers themselves, the adsorption and the retention of soil (particles) such as fine dusts are improved, compared with those of a general planar unwoven fabric, however, the projections and depressions sufficient for trapping large soil (particles) such as basis weight utilizing the projections and depressions of the unwoven fabric cannot be obtained.

[0007]

Also, if said unwoven fabric is impregnated with an oily material, a stickiness equivalent to that of the case where a general planar unwoven fabric is impregnated with an oily material is apt to be caused, and the user is apt to experience unpleasantness.

[0008]

In the bulking of cushion materials using a nonwoven fabric, when the unwoven fabric is integrated with film having a bulking characteristic, etc., adhering and fusing are carried out, so that the degree of freedom of fibers of the unwoven fabric is markedly lowered. In general, the unwoven fabric as a cleaning article tends to strengthen the junction of the fibers so that it



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does not discharge fiber flocks or is not broken during cleaning, however the decrease of the degree of freedom of the unwoven fabric fibers reduces the ability to trap of cotton lint, yarn flocks, hairs, etc., caused by an entangling effect of the unwoven fabric fibers.

[0009]

Therefore, the purpose of the present invention is to provide a cleaning article which is excellent in the ability to trap large stains such as basis weight utilizing projections and depressions of a nonwoven fabric and the ability to trap cotton lint, yarn flocks, hairs, etc., caused by an entangling effect of unwoven fabric fibers with a high degree of freedom, not to mention excellent adsorption and retention of stains [particles] such as fine dusts, from which it is difficult to discharge the fiber flocks during cleaning or is difficult to tear [the sheet], and causes little stickiness of hands, and its manufacturing method.

[0010]

Means to solve the problems

In order to achieve the above-mentioned purpose, the present invention provides a cleaning article characterized by the fact that on a cleaning sheet, in which a fiber assembly in the shape of a nonwoven fabric formed on one surface or both surfaces of a netted sheet by entangling fibers of a fiber web, is also integrated in an entangled state with said netted sheet along

with entangling between its constituting fibers, and in which many projections and depressions are formed on the surface of the above-mentioned fiber assembly, and [can which] 0.1-500% chemical relative to the weight of the above-mentioned fiber assembly is carried.

[0011]

The present invention also provides a method for manufacturing the cleaning article characterized by the fact that in a method for manufacturing the cleaning article of Claim 1, a fiber web is laminated on one surface or both surfaces of a heat-shrinkable netted sheet, a fiber assembly is formed in the shape of a nonwoven fabric by entangling the constituting fibers of the above-mentioned fiber web and the netted sheet or the constituting fibers of the above-mentioned fiber web, it is integrated with the netted sheet, the above-mentioned netted sheet is thermally shrunk by heating, a cleaning sheet is prepared by providing concave and convex shapes over the entire fiber assembly part with a nonwoven fabric shape, and said cleaning sheet is impregnated with a chemical before or after heating said cleaning sheet.

[0012]

In the present invention, since the netted sheet only shrinks and does not substantially form projections and depressions and the fiber assembly does not substantially shrink and is integrated with the netted sheet, the fiber assembly in the net rises, so that many projections and depressions are

formed. Also, the fiber assembly in the present invention means that the constituting fibers are entangled, and the fiber web means a state prior to being entangled.

[0013]

#### Function

In the cleaning article of the present invention, since the cleaning sheet forms the fiber assembly in the shape of a nonwoven fabric integrated in an entangled state with the netted sheet along with entangling between the fibers of the fiber web, and when the heat-shrinkable netted sheet is shrunken, the fibers constituting the fiber assembly in the shape of a nonwoven fabric are raised and arranged in a wave shape, so that the degree of freedom of the fibers is increased. Thereby, many projections and depressions are provided, and the entire sheet becomes bulky. Thus, small to relatively large soil [particles] such as crumbs and hairs are entangled, and a broad variety of soil [particles] are reliably trapped. With the entanglement and integration with the netted sheet, it is difficult to discharge fiber flocks, and the sheet is difficult to tear.

[0014]

Furthermore, with the amount of chemical carried in the cleaning article of the present invention, stickiness due to the chemical is slight, while a sufficient cleaning effect is given.

[0015]

#### Application examples

Next, referring to the attached figures, application examples of the present invention are explained in detail. Figure 1 is a cross section showing a state in which a netted sheet and a fiber web are superposed at the initial stage of the manufacture of the cleaning being used in the first application example of the present invention. Figure 2 is a cross section showing a state in which a netted sheet and a fiber web are superposed at the initial stage of the manufacture of the cleaning sheet used in the second application example of the present invention. Figure 3 is a cross section showing an example of the completed product of the cleaning sheet shown in Figure 1. Figure 4 is a cross section showing an example of the completed product of the cleaning sheet shown in Figure 2. Figure 5 is an outlined diagram showing the entire manufacturing apparatus appropriately used in manufacturing the cleaning sheet shown in Figure 4. Figure 6 is a plan view showing a net used as a netted sheet. Figure 7 is a plan view showing a netted web being used as a netted sheet. Figure 8 is a plan view showing a film with holes being used as a netted sheet. Figure 9 is an oblique view showing a state in which a cleaning sheet is mounted on a tool with a handle.

[0016]

First, the cleaning article of the first application example of the present invention shown in Figure 3 is explained. The

cleaning article of the first application example is characterized by the fact that on a cleaning sheet 10, in which a fiber assembly 12 in the shape of a nonwoven fabric formed on one surface of a netted sheet 11 (13,14) by entangling of fibers is also integrated in an entangled state with said netted sheet 11 (13,14), along with entangling between its constituting fibers, and in which many depressions and concave parts 12A and 12B are formed on the surface of the above-mentioned fiber assembly 12, and [on which] 0.1-500% chemical relative to the weight of the above-mentioned fiber assembly 12 is carried.

[0017]

The above-mentioned netted sheet 11 (13,14) is a broad concept including a film with many holes; for example, the net 11 as shown in Figure 6, netted web 13 composed of a latent crimping fiber assembly, in which holes are formed, as shown in Figure 7, and film 14 with many holes as shown in Figure 8, are included.

[0018]

With the above-mentioned net 11 as the above-mentioned netted sheet, shown in Figure 6, a net formed in the shape of a lattice as a whole is used, however the shape of the holes being formed in the netted sheet 11 (13,14) can be variously changed. For example, as shown in Figure 8, the shape of the holes of the film 14 with holes may be a star-like shape as shown in (a), or a round shape as shown in (b), or a combination of the round shape and the star-like shape as shown in (c).

[0019]

Also, in the above-mentioned fiber assembly 12, as shown in Figure 3, the noncontact part with the netted shape 11 (13,14) is formed as the depression 12A, and the contact part with the netted shape 11 (13,14) is formed as the concave part 12B. Then, in the above-mentioned fiber assembly, convex and concave surfaces with a cushion are formed by many depressions 12A and the concave parts 12B between the depressions.

[0020]

The surface of the above-mentioned fiber assembly 12 is constituted by entangled fibers, and fine soil [particles] attached to the surface being cleaned are trapped between these constituting fibers.

[0021]

As the constituting fibers of the above-mentioned fiber assembly 12, for example, thermoplastic fibers such as polyesters, polyamides, and polyolefins, or composites of these fibers, split fibers, or very fine fibers manufactured by a melt-blowing method, etc., semisynthetic fibers such as acetate, regenerated fibers such as cupra and rayon, and natural fibers such as cotton may be used. The basis weight of the fiber assembly, which constitutes the fiber assembly part in the shape of a nonwoven fabric, size, fiber length, cross section shape, degree of entangling, and strength is determined in accordance with the purpose of use, considering workability, cost, etc.

[0022]

With the net 11 as the above-mentioned netted sheet, a heat-shrinkable net is preferably used. With the use of such a heat-shrinkable net, in manufacturing the cleaning sheet 10, many concave parts and depressions can be formed on the surface of the above-mentioned fiber assembly by heat shrinkage from a heat treatment of the above-mentioned heat-shrinkable net. The above-mentioned heat-shrinkable net is a net composed of a thermoplastic polymer, for example, polyolefins such as polyethylene, polypropylene, and polybutene, polyesters such as polyethylene terephthalate and polybutylene terephthalate, polyamides such as nylon 6 and nylon 66, acrylonitriles, vinyls, vinylidenes such as polyvinyl chloride and polyvinylidene chloride, or modified products of these, alloys [sic], mixtures of these, etc. In accordance with the projections and depressions of an intended cleaning sheet, a net shrunk in a monoaxial or biaxial direction and a net woven or knitted using a heat-shrinkable filament as the above-mentioned thermoplastic polymer in at least either the warp or weft are preferable. The net is appropriately selected in accordance with the concave and convex shapes of the intended cleaning sheet.

[0023]

As the above-mentioned film 14 with holes as the above-mentioned netted sheet, a film shrunk in a monoaxial or biaxial direction as the above-mentioned thermoplastic polymer, in which holes are opened by punching, etc., can be used.



[0024]

Also, with the above-mentioned netted web 13 as the above-mentioned netted sheet, for example, a web constituted by heat-shrinkable fibers or latent crimping fibers that are crimped by heating, or mixtures of these, which are comprised of monoolefin polymer and copolymers such as ethylene, propylene, and butene, high-density polyethylene, low-density polyethylene, linear low-density-polyethylene, polypropylene, ethylene-propylene copolymer, ethylene-vinyl acetate copolymer, ester polymers and copolymers such as polyethylene terephthalate and polybutylene terephthalate, vinyl and vinylidene polymers and copolymer such as polyvinyl chloride and polyvinylidene chloride, polyamide polymers and copolymers such as nylon 6 and nylon 66, acrylonitrile polymers and copolymers, or mixtures of these. In the web, these fibers are integrated in a mutually entangled state.

[0025]

As the netted web 13, one may use a fiber assembly sheet with a netted pattern formed in the shape of a net, using a fiber web, by a high-speed liquid flow or air flow and in which its constituting fibers are mutually entangled, or a fiber assembly sheet in which holes are opened in a sheet-shaped product, where its constituting fibers are mutually entangled and integrated by punching, etc., at a specific hole diameter and hole pitch in a hole pattern, or a netted sheet with specific hole diameter, hole pitch, and hole pattern, in which its constituting fibers manufactured by other methods are entangled and integrated.

[0026]

If the above-mentioned net 11 is used as the above-mentioned netted sheet, it is necessary to determine its mesh, line diameter, distance between lines, hole diameter, hole pitch, hole pattern, etc., considering the shrinkability of the net 11, the shape and degree of the depressions and concave parts 12A and 12B formed by shrinkage of the net 11, partial entangling characteristic with the fiber assembly in the shape of a nonwoven fabric, etc. Specifically, the line diameter is preferably 20-500  $\mu\text{m}$ , more preferably 100-200  $\mu\text{m}$ , and the distance between lines is preferably 2-30 mm, more preferably 4-20 mm.

[0027]

If the above-mentioned netted web 13 or the above-mentioned film 14 with holes is used as the above-mentioned netted sheet, its open hole diameter is preferably 4-40 mm, more preferably 8-20 mm, and the interval between the open holes is 2-20 mm, more preferably 4-10 mm. If others are used as the above-mentioned netted sheet, the hole diameter, etc., can be selected based on the above-mentioned netted sheet.

[0028]

Next, the cleaning article of the second application example of the present invention shown in Figure 4 is explained. In the cleaning article of the second application example, the fiber assembly 12 is arranged on both surfaces of the netted sheet 11 (13,14), and the cleaning article is constituted similarly to the

above-mentioned first application example except for arranging the fiber assembly 12 on both surfaces of the netted sheet 11 (13,14).

[0029]

In the cleaning sheet in which the fiber assembly is arranged on both surfaces of the netted sheet as shown in the second application example, the fiber assemblies of both surfaces of the sheet may be the same or different. A product that can be used by being divided on both surfaces in accordance with the purpose of use or a product with a different hand on each surface of the sheet can be formed by using different fiber assemblies on the two surfaces of the sheet, such as different kinds of constituting fibers.

[0030]

In the cleaning product of the present invention, 0.1-500 wt% (based on the fiber assembly weight) of a chemical relative to the weight weight is carried on the above-mentioned fiber assembly 12 of the above-mentioned cleaning sheet 10. As such a chemical, one mainly composed of an oily component for dry cleaning, a detergent for wet cleaning, etc., can be mentioned.

[0031]

As the above-mentioned oil component, at least one or more selected from mineral oil, synthetic oil, silicone oil, and surfactant are preferably included.

[0032]

As the above-mentioned mineral oil, paraffin hydrocarbons, naphthene hydrocarbons, aromatic hydrocarbons, etc., are used.

[0033]

As the above-mentioned synthetic oil, alkylbenzene oil, polyolefin oil, polyglycol oil, etc., are used, and as the above-mentioned silicone oil, chain dimethylpolysiloxane, cyclic dimethylpolysiloxane, methylhydrogenpolysiloxane, or various kinds of modified silicones are used.

[0034]

In the above-mentioned surfactant, as a cationic group, long-chain monoalkyltrimethylammonium salts having an alkyl group or alkenyl group with 10-22 carbons, long-chain dialkyldimethylammonium salts, long-chain monoalkyldimethylbenzylammonium salts, etc., are mentioned, and as a nonionic group, polyethylene glycol ethers such as polyoxyethylene (6-35 mol) long-chain alkyl or alkenyl (primary or secondary C<sub>8</sub>-C<sub>22</sub>) ethers and polyoxyethylene (6-35 mol) alkyl (C<sub>8</sub>-C<sub>18</sub>) phenyl ether, polyvalent alcohols such as polyoxyethylene polyoxypropylene block copolymer, or glycerin fatty esters, sorbitan fatty esters, alkyl glycoxides, etc., are mentioned. The above-mentioned surfactant preferably includes 5 wt% or less water for effective washing.

[0035]

The viscosity (25°C) of the above-mentioned mineral oil, synthetic oil, and silicone oil is preferably 5-1000 cPs, especially preferably 5-200 cPs. If the viscosity is less than 5 cPs, the adsorption of soil [particles] is poor. If the viscosity is more than 1000 cPs, the oil component is difficult to uniformly spread on the fibers, and the friction coefficient with the surface to be cleaned is increased, so that said surface is damaged. The surface tension (25°C) is preferably 15-45 dyn/cm, especially preferably 20-35 dyn/cm. If the surface tension is less than 15 dyn/cm, the adsorption of soil [particles] is poor, and if the surface tension is more than 45 dyn/cm, uniform spreading on the fibers constituting the nonwoven fabric is difficult.

[0036]

The amount of said oil component carried is 0.1-80%, preferably 0.5-40%, and especially preferably 1-20% relative to the weight of the fiber assembly; the soil absorption [sic; adsorption] and the soil retention can be increased by carrying it at that ratio. If the amount of oil component carried is less than 0.1%, the increase of the soil absorption and the soil retention due to the addition of the oil component is not sufficient, and if the amount is more than 80%, stickiness to the hands is markedly increased. In the cleaning article of the present invention, since concave parts and depressions are formed on the surface of the fiber assembly, although a relatively large amount of oil component is carried on the fiber assembly, the

attachment of the oil component to hands during contact is slight, and the stickiness is slight.

[0037]

Said oil component, as mentioned above, preferably includes at least one selected from mineral oil, synthetic oil, silicone oil, and surfactant, however, its ratio and kind, viscosity of said oil agent, surface tension, etc., are appropriately determined in accordance with the cleaning purpose and the kind of fibers constituting the nonwoven fabric. If necessary, an antibacterial agent, antimold agent, antiseptic, etc., can be included.

[0038]

The above-mentioned detergent is preferably an aqueous solution containing at least one kind or more selected from surfactants, solvents, and alkali agents.

[0039]

As the above-mentioned surfactant, various kinds of surfactants such as nonionic, cationic, anionic, and amphoteric surfactants are mentioned. As the above-mentioned anionic surfactants, ordinary sulfonate anionic surfactants and sulfate anionic surfactants are used. As the sulfonate anionic surfactant, there are straight-chain or branched alkyl ( $C_8-C_{22}$ ) benzenesulfonates, long-chain alkyl ( $C_8-C_{22}$ ) sulfonates, long-chain olefin ( $C_8-C_{22}$ ) sulfonates, etc. As the sulfate anionic

surfactant, there are long-chain monoalkyl ( $C_8-C_{22}$ ) sulfuric acid ester salts, polyoxyethylene (1-6 mol) long-chain alkyl ( $C_8-C_{22}$ ) ether sulfuric acid ester salts, polyoxyethylene (1-6 mol) alkyl ( $C_8-C_{18}$ ) phenyl ether sulfuric acid ester salt, etc. As the cation as the pair of ions of these anionic surfactants, alkali metal ions such as sodium and potassium alkanolamine ions such as monoethanolamines, diethanolamines, and triethanolamines are mentioned. In terms of strong resistance to hydrolysis, etc., as the anionic group surfactant, sulfonate surfactants are preferable. Furthermore, in terms of detergency, the long-chain or branched alkylbenzenesulfonates are preferable. As the above-mentioned amphoteric surfactant, carbobetaines having an alkyl group with 8-22 carbons, sulfobetaines, hydroxysulfobetaines, etc., are mentioned. As the above-mentioned nonionic surfactant and cationic surfactant, substances similar to those being included in the above-mentioned oil component are mentioned. As the above-mentioned solvent, alcohols such as ethanol and isopropanol, glycols such as ethylene glycol and propylene glycol, glycol ethers such as ethylene glycol monoethyl ether and propylene glycol monomethyl ether are mentioned, and as the above-mentioned alkali agent, alkanolamines such as monoethanolamine, etc., are mentioned. In the above-mentioned detergent, if necessary, an antiseptic, deodorant, perfume, etc., can be included. The amount of these detergents carried is 50-500%, preferably 100-300% relative to the weight of the fiber assembly; the detergent effect on dirt and stains from hands can be enhanced by carrying it at this ratio. If the amount of detergent carried is less than 50%, the cleaning area is too small, and if the amount is more than 500%, deterative substances

not completely retained in the sheet are dropped during cleaning, which is not preferable.

[0040]

The cleaning sheet of the present invention is directly used in cleaning by hand operation, or it can be used as a cleaning article by mounting on a tool with a handle. The form of the tool with a handle is not specially limited, however a mop, handy mop and duster are mentioned. In particular, a cleaning part with a planar form is preferable in terms of large areas [to be cleaned]. Figure 9 shows an example of the above-mentioned tool with a handle. In the figure, 40 is said cleaning part. Thus, place such as gaps between furniture, etc., ceiling, etc., difficult to reach by hand, can be cleaned with said cleaning sheet by mounting said cleaning sheet on the tool with a handle, so that the excellent performance of said cleaning sheet can be sufficiently exerted by retaining fine soil [particles], crumbs, hairs, cotton lint, etc., which are trapped.

[0041]

Next, a preferable application example of the method for manufacturing the cleaning article of the present invention is explained.

[0042]

As shown in Figures 1 and 2, after the fiber web is laminated on one surface or both surfaces of the netted sheet 11



(13,14) which is heat-shrinkable in a monoaxial or biaxial direction, fibers of the fiber web 12 on one surface of the netted sheet 11 (13,14) and fibers of the fiber web 12 on the other surface and the fibers of the fiber web 12 and the netted sheet 11 (13,14) are entangled and integrated by a water flow, and each fiber web 12 is changed to a fiber assembly in the shape of a nonwoven fabric by entangling. Then, the fiber assembly obtained is dried and/or the heat-shrinkable netted sheet 11 (13,14) is thermally shrunk separately from the drying process, so that the constituting fibers of said fiber assembly in the shape of a nonwoven fabric are raised and arranged in a wave shape, thereby giving projections and depressions as a whole.

[0043]

In other words, as shown in Figure 5, the fiber web 12 is continuously drawn out via a drawer 22 from both carding machines 21A and 21B for manufacturing the fiber web 12. On the other hand, a roll 23 of the netted sheet 11 (13,14) is arranged between the carding machines 21A and 21B, and the netted sheet 11 (13,14) is drawn out from a drawing roll 25 of the roll 23.

[0044]

Then, the fiber web 12 is superposed at both sides of the netted sheet 11 (13,14) by the above-mentioned drawing roll 22 [sic; 23] and carried into a water needling device 26. Here, the fibers of the fiber web 12 and the netted sheet are entangled by a water jet flow, and the fiber webs 12 at both sides of the

netted sheet 11 (13,14) are entangled, so that a sheet as shown in Figure 2 is manufactured.

[0045]

After entangling, the fiber assembly 12 and the netted sheet 11 (13,14) are carried into a heater 28 for drying and thermally shrinking through a nip roll 27 and heat-treated. With the heat treatment, the netted sheet 11 (13,14) is thermally shrunk; as an example, as shown in Figure 4, the depressions 12A and the concave parts 12B are formed in the fiber assembly in the shape of a nonwoven fabric entangled with the netted sheet 11 (13,14). In the heating process by the heater 28, the fiber assembly 12 with a nonwoven fabric shape and the heat-shrinkable integrated netted sheet 11 (13,14) is treated at an appropriate temperature for an appropriate time. These conditions depend on the heat-shrinkable netted sheet 11 (13,14), however, the conditions for the shrinkage rate for obtaining necessary concave and convex shapes may be adopted. However, in a continuously joined sheet, when the sheet is shrunk in the flow direction of said sheet, the speed difference at the inlet and outlet of the heat treatment part is an important factor. In other words, if the tensile strength is greater than the shrinkage stress, the speed ratio is preferably fitted to one close to the necessary shrinkage rate.

[0046]

As a method for carrying the chemical on the cleaning sheet, there is no special limitation, however, for example, as shown in Figure 5, a sprayer 31 arranged between the nip roll 29 and a

winder 30 is adopted. Whether the addition of the chemical is prior to the heat treatment of the fiber assembly and the netted sheet or after the heat treatment is appropriately determined in accordance with the kind of said chemical.

[0047]

If the cleaning sheet is a continuous sheet, it may be wound into a roll, and it may also be cut into a necessary size, folded as needed, and packaged.

[0048]

After adding the chemical, the cleaning article is wound on the winder 30 via the nip roll 29.

[0049]

As shown in Figure 1, if the fiber web 12 is laminated on one surface of the netted sheet 11 (13,14), when the part not in contact with the netted sheet 11 (13,14) is formed as the depression 12A, in general, the depression 12A is not only formed on one surface of the netted sheet 11 (13,14) as shown in Figure 3, but the depression 12A is also formed at random on both surfaces of the netted sheet 11 (13,14), so that concave and convex surfaces are formed over its entirety. Similarly, as shown in Figure 2, even when the fiber web 12 is laminated on both surfaces of the netted sheet 11 (13,14), when the constituting fibers between the fiber assemblies arranged on both surfaces of the netted sheet 11 (13,14) are entangled at the part not in

contact with the netted sheet 11 (13,14), the depressions 12A projecting on both surfaces of the netted sheet 11 (13,14) of Figure 4 are integrated, so that the depressions 12A are formed on any surface of said sheet. Thereby, the depressions 12A are formed at random on both surfaces of the netted sheet 11 (13,14), and convex and concave surfaces are formed over its entirety. All these cases are also included in the application example of the present invention.

[0050]

As the netted sheet, when a film with open holes is used and when a net with a thick line diameter and small opened holes is used, since the fiber assemblies on the surface and the back face are strongly entangled through the holes and the fibers on the film or lattices are difficult to entangle with the film with open holes or net, contrary to the contrary to the above-mentioned case, the fibers on the film or lattices are raised, so that concave and convex shapes are formed. In particular, when a net is used as the netted sheet and the fiber web is laminated on both its surfaces and entangled, since the fibers of the fiber web are strongly entangled through the holes of the net, concave parts are apt to be formed.

[0051]

Based on the embodied application examples, the cleaning article of the present invention is explained.

### Application Product 1

Using a polyester fiber of 1.5 d and 51 mm, a fiber web with a basis weight of  $10 \text{ g/m}^2$  was formed by a carding machine according to an ordinary method, and the fiber web was lapped (not shown in the figure) in three layers ( $30 \text{ g/m}^2$ ). A biaxially shrinkable net (5 mesh/line diameter of 0.2 mm) of polypropylene as a netted sheet was laminated on the intermediate layer, and said fiber web was laminated on the upper and lower layers. Then, they were entangled by water needling. At that time, the water needling was carried out at a water pressure of  $40 \text{ kg/cm}^2$ , a nozzle pitch of 1.6 mm, and a speed of 5 m/min. Then, it was heat-treated for 50 sec with hot air at  $130^\circ\text{C}$  and dried, and the net was shrunk. Then, a chemical (a viscosity of 125 cPs and a surface tension of 30 dyn/cm) composed of 95% liquid paraffin and 5% nonionic surfactant (polyoxyethylene (an average addition mole number of 3.3) alkyl ( $\text{C}_{12}\text{-C}_{13}$ ) ether) was applied at a ratio of 5% relative to the fiber weight (weight of the fiber assembly) by spraying, so that an Application Product 1 having projections and depressions on the surface with an area shrinkage rate of 10% was obtained.

[0052]

### Application Product 2

Using a mixed cotton of 6 parts polyester fiber of 1.5 d and 51 mm and 4 parts rayon fiber of 3 d and 51 mm, a fiber web with a basis weight of  $10 \text{ g/m}^2$  was formed by a carding machine according to an ordinary method, and the fiber web was lapped

(not shown in the figure) in five layers (a basis weight of 50 g/m<sup>2</sup>). Then, a biaxially shrinkable net (5 mesh/line diameter of 0.2 mm) of propylene as a netted sheet was laminated on the lower layer, and said fiber web was laminated on the upper layer. Then, they were entangled by water needling. At that time, the water needling was carried out at a water pressure of 40 kg/cm<sup>2</sup>, a nozzle pitch of 1.6 mm, and a speed of 5 m/min. Then, the fiber assembly was dried, and silicone (Toray Silicone SM5571) was applied at a ratio of 10% relative to the fiber weight (weight of the fiber assembly) by gravure coating. Thereafter, the net was shrunk by heat-treating for 60 sec with hot air of 130°C, so that an Application Product 2 having projections and depressions on the surface with an area shrinkage rate of 25% was obtained.

[0053]

### Application Product 3

Using a kneaded mixture of 5 parts polyester fiber of 1.5 d and 51 mm and 5 parts rayon fiber of 1.5 d and 51 mm, a fiber web with a basis weight of 10 g/m<sup>2</sup> was formed by a carding machine according to an ordinary method, and the fiber web was lapped (not shown in the figure) in two layers (a basis weight of 20 g/m<sup>2</sup>). Then, a biaxially shrinkable net (5 mesh/line diameter of 0.2 mm) of propylene as a netted sheet was laminated on the intermediate layer, and said fiber web was laminated on the upper and lower layers. Then, they were entangled by water needling. At that time, the water needling was carried out at a water pressure of 40 kg/cm<sup>2</sup>, a nozzle pitch of 1.6 mm, and a speed of 5 m/min. Then, it was dried by heat-treating for 30 sec with hot air at

145°C, and the net was shrunk. Then, a chemical composed of an aqueous solution containing 0.5% nonionic surfactant (polyoxyethylene (an average addition mole number of 5) alkyl (C<sub>12</sub>-C<sub>13</sub>) ether), 5% ethanol, and 5% propylene glycol monomethyl ether was applied at a ratio of 120% relative to the fiber weight (weight of the fiber assembly) by spraying, so that an Application Product 3 having projections and depressions on the surface with an area shrinkage rate of 15% was obtained.

[0054]

#### Comparative Product 1

In the Application Product 1, the shrinking process was omitted, and a product in which no projections and depressions were formed on the surface was used as Comparative Product 1. Except for that, said Comparative Product 1 was prepared similarly to Application Product 1.

[0055]

#### Comparative Product 2

In Application Product 1, a product to which no chemical was applied was used as Comparative Product 2. Except for that, said Comparative Product 2 was prepared similarly to Application Product 1.

[0056]

### Comparative Product 3

Using a polyester fiber of 1.5 d and 51 mm, a fiber web with a basis weight of  $10 \text{ g/m}^2$  was formed by a carding machine according to an ordinary method, and the fiber web was lapped (not shown in the figure) in seven layers (a basis weight of  $70 \text{ g/m}^2$ ) and entangled by water needling. At that time, the water needling was carried out at a water pressure of  $40 \text{ kg/cm}^2$ , a nozzle pitch of 1.6 mm, and a speed of 5 m/min. Then, a chemical similar to that of application product 1 was applied by spraying, so that a comparative product 3 was obtained.

[0057]

### Comparative Product 4

Using a polyester fiber of 1.5 d and 51 mm, a fiber web with a basis weight of  $10 \text{ g/m}^2$  was formed by carding machine according to an ordinary method, and the fiber web was lapped (not shown in the figure) in five layers (a basis weight of  $50 \text{ g/m}^2$ ) and entangled by a water needling. At that time, the water needling was carried out at a water pressure of  $40 \text{ kg/cm}^2$ , a nozzle pitch of 600 pieces/m, and a speed of 5 m/min. Then, a chemical similar to that of the Application Product 1 was applied to said fiber assembly by spraying, and a pleated sheet with a shrinkage rate of 25% was manufactured by sewing a rubber Canton yarn (made by Ushida K.K.) at a stretch rate of 125% at four places in a flow direction by a sewing machine and labeled Comparative Product 4.



[0058]

Comparative Product 5

In Comparative Product 3, using a PP (polypropylene) crimping fiber of 1.5 d and 51 mm as the raw material for the fiber web, Comparative Product 5 was obtained.

[0059]

Comparative Product 6

A heat-shrinkable PP (polypropylene) film without holes was partially heat-fused on one surface of Comparative Product 3 by ultrasonic waves and heat-treated for 30 sec with hot air of 110°C, so that Comparative Product 6 having projections and depressions on the surface with an area shrinkage rate of 10% was obtained.

[0060]

The following evaluation was carried out for each of the above-mentioned application products and comparative products. The results are shown in the following table (Table I).

[0061]

1. Soil ability to trap

1 g soil species 7 (JIS Z 8901) for testing, similar to the composition of sandy soil, was uniformly sprayed in a 30 x 30 cm area [of a surface to be cleaned], and attached and fixed to each of the above-mentioned application products and comparative products [which were on] sponges sized 7 x 11 cm by wiping back and forth 10 times. The amount of soil adsorbed by each application product and comparative example was labeled the amount adsorbed.

[0062]

The surface of each application product and comparative product attached to the bottom surface of the above-mentioned sponges, and dropped 10 times from a height of 30 cm. After extra soil is removed, the amount of soil remaining in each application product and comparative product was labeled the amount retained.

[0063]

2. Ability to trap hair

10 human head hairs of 10 cm were dispersed so that they were not superposed, and were fixed to each of application products and comparative products [which were on] sponges sized 7 x 11 cm by wiping back and forth three times. Then, the

detaching ease of the hairs and the dropping difficulty were functionally evaluated.

[0064]

The evaluation references of the functional evaluation are as follows.

⊙: 8-10 hairs are reliably detached [from the cleaned surface], and the detached hairs drop off [the cleaning product] with difficulty.

O: 8-10 hairs are reliably detached, however the detached hairs sometimes drop off.

Δ: 5-7 hairs are detached, however the detached hairs easily drop off.

x: 5 or more hairs are not detached.

[0065]

### 3. Ability to trap crumbs

1 g crumbs (soft crumbs made by Nissin Flour Milling Co., Ltd.) was dispersed are an area of 30 x 30 cm [to be cleaned], and attached and fixed to each of the above-mentioned application products and comparative products [which were on] sponges sized 7 x 11 cm by wiping back and forth three times. Then, the detaching ease of the crumbs and the dropping difficulty were functionally evaluated.

[0066]

The evaluation references of the functional evaluation are as follows.

⊙: Almost all the crumbs are reliably detached [from the cleaned surface], and the detached crumbs drop off [the cleaning product] with difficulty.

○: Most of the crumbs are detached, however the detached crumbs are sometimes drop off.

△: Part of the crumbs are detached, however the detached crumbs are easily drop off.

×: The crumbs are seldom detached.

[0067]

#### 4. Effective utilization of unwoven fabric

1 g soil species 7 (JIS z 89010 for testing, similar to the composition of sandy soil, was uniformly sprayed over an area of 30 x 30 cm [to be cleaned], and attached and fixed to each of the above-mentioned application products and comparative products [which were on] sponges sized 7x 11 cm by wiping back and forth 10 times. The degree of soiling of the surface of the cleaning article was evaluated by the naked eyes.

[0068]

The evaluation references of the functional evaluation are as follows.

○: Almost the entire area of the cleaning article is soiled.

Δ: 50% or more of the area is soiled, though not the entire surface of the cleaning article.

x: Less than 50% of the area of the cleaning article is soiled.

[0069]

## 5. Stickiness

The functional evaluation of the stickiness was carried out by touching each of the above-mentioned application products and comparative products by the hands.

[0070]

The evaluation references of the functional evaluation are as follows.

O: Stickiness is seldom felt.

Δ: A slight stickiness is felt.

X: Extreme stickiness felt.

[0071]

Table I

		① ダスト吸着 量 (g)	② ダスト保持 量 (g)	③ 髪の毛 捕集能	④ パンくず 捕集能	⑤ 有効利 用性	⑥ べたっ き性
⑦ 実 施 品	1	0.80	0.32	◎	◎	○	○
	2	0.84	0.40	◎	◎	○	○
	3	0.88	0.60	◎	◎	○	○
⑧ 比 較 品	1	0.64	0.24	○	×	○	×
	2	0.40	0.15	×	△	○	○
	3	0.60	0.22	○	×	○	×
	4	0.69	0.20	○	△	×	△
	5	0.60	0.24	×	×	○	×
	6	0.68	0.22	△	×	△	△

Key: 1 Amount of dust adsorbed (g)  
 2 Amount of dust retained (g)  
 3 Hair ability to trap  
 4 Crumb ability to trap  
 5 Effective utilization  
 6 Stickiness  
 7 Application Product  
 8 Comparative product

[0072]

As seen from Table I, according to the cleaning articles of the application products, as for each evaluation item of the amount of soil adsorbed, amount of soil retained, ability to trap hair, ability to trap crumbs, effective utilization of a nonwoven fabric, and stickiness, favorable results were obtained. On the contrary, in each comparative product, the amount of soil adsorbed and the amount of soil retained are inferior; even if part of the evaluations are good, the other evaluations are not satisfactory.

[0073]

In other words, according to this application example, the soil absorption and the soil retention are excellent, and the ability to trap large soil [particles] such as hairs and crumbs is also excellent. Furthermore, the stickiness to hands is seldom felt.

[0074]

The present invention is not limited to the above-mentioned application examples, but can be variously modified in the range where the essence of the present invention is not deviated from.

[0075]

For example, as a method for carrying the chemical on the cleaning sheet, dipping said cleaning sheet into the chemical, etc., may also be adopted.

[0076]

#### Effect of the invention

According to the cleaning article of the present invention, the ability to trap large soil [particles] such as basis weight utilizing projections and depressions of a nonwoven fabric and the ability to trap cotton lint, yarn flocks, hairs, etc., caused by an entangling effect of unwoven fabric fibers with a high degree of freedom, not to mention excellent adsorption and retention of soil [particles] such as fine dust, is excellent. It is difficult to discharge the fiber flocks during cleaning, and the article is difficult to tear, and the stickiness to hands is slight.

[0077]

According to the method for manufacturing the cleaning article of the present invention, the above-mentioned cleaning article can be appropriately manufactured.



### Brief description of the figures

#### Figure 1

Figure 1 is a cross section showing the state in which a netted sheet and a fiber web are superposed at the initial stage of the manufacture of the cleaning sheet used in the first application example of the present invention.

#### Figure 2

Figure 2 is a cross section showing the state in which a netted sheet and a fiber web are superposed at the initial stage of the manufacture of the cleaning sheet used in the second application example of the present invention.

#### Figure 3

Figure 3 is a cross section showing an example of the completed product of the cleaning sheet shown in Figure 1.

#### Figure 4

Figure 4 is a cross section showing an example of the completed product of the cleaning sheet shown in Figure 2.

#### Figure 5

Figure 5 is an outlined diagram showing the entire manufacturing apparatus appropriately used in manufacturing the cleaning sheet shown in Figure 4.

#### Figure 6

Figure 6 is a plan view showing a net used as a netted sheet.

Figure 7

Figure 7 is a plan view showing a netted web used as a netted sheet.

Figure 8

Figure 8 is a plan view showing a film with holes used as a netted sheet.

Figure 9

Figure 9 is an oblique view showing a state in which a cleaning sheet is mounted on a tool with a handle.

- |            |                               |
|------------|-------------------------------|
| 10         | Cleaning sheet                |
| 11 (13,14) | Netted sheet                  |
| 12         | Fiber assembly (or fiber web) |
| 12A        | Depression                    |
| 12B        | Concave part                  |

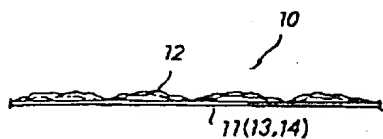


Figure 1

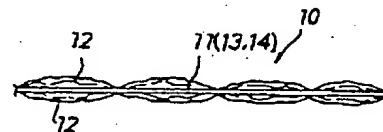


Figure 2

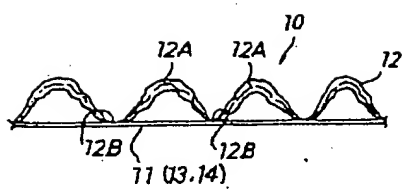


Figure 3

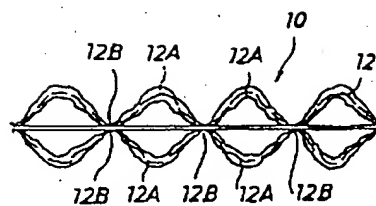


Figure 4

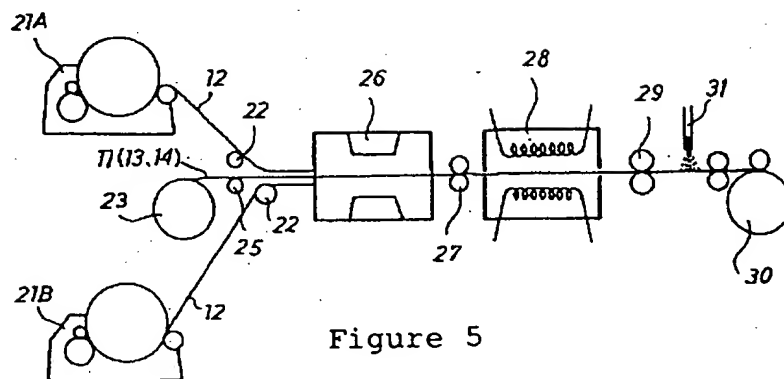


Figure 5

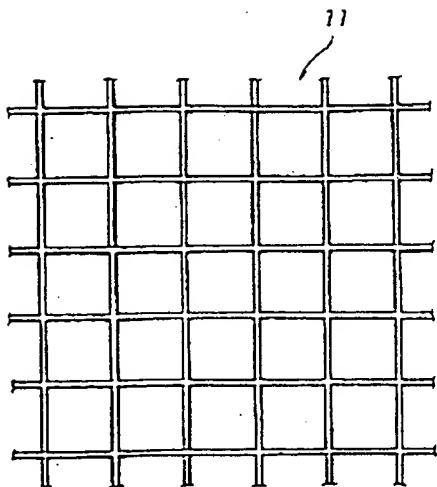


Figure 6

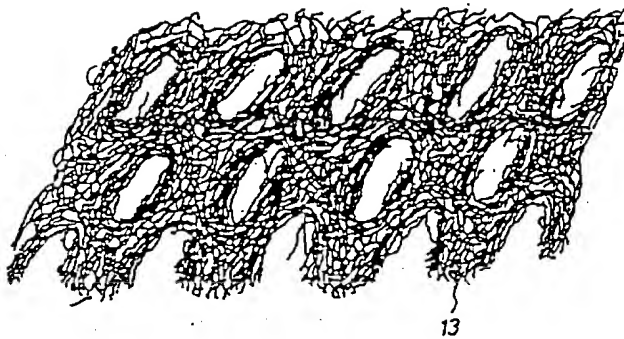


Figure 7

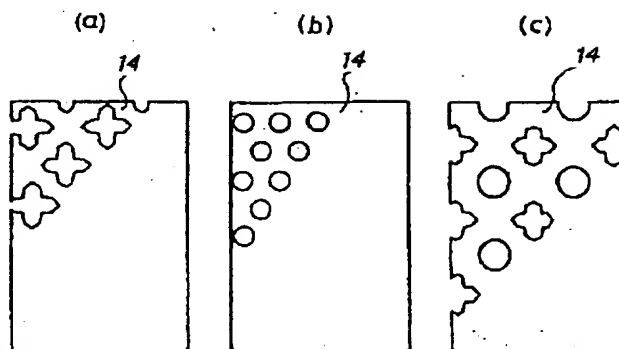


Figure 8

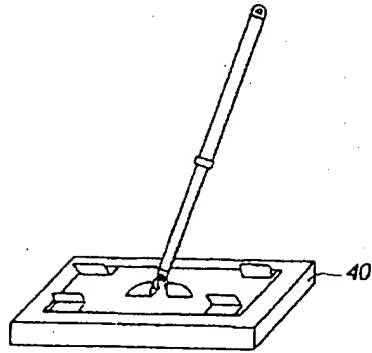


Figure 9

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